Electronic Supplementary Information (ESI) of

Enhancement of ion dynamics in organic ionic plastic crystal/PVDF composite electrolytes prepared by co-electrospinning

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1. Synchrotron XRD measurements

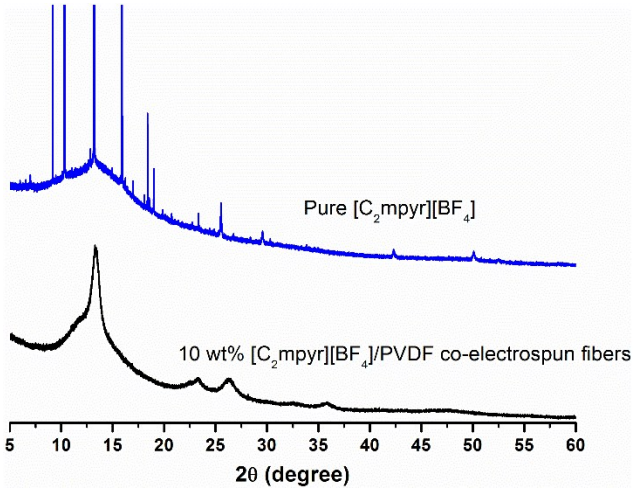

Fig. S1. Synchrotron X-ray diffraction patterns of co-electropsun fibres and pure [C_2mpyr][BF_4]

Fig. S1. presents the synchrotron X-ray diffraction patterns of co-electropsun fibres as well as pure [C_2mpyr][BF_4] acquired at room temperature (detailed experimental parameters can be found in our published work [1]). It can be clearly found that no OIPC diffraction peaks were detected in co-electrospun fibres (10 wt.% OIPC composite), indicating amorphous [C_2mpyr][BF_4] was formed after electrospinning. This conclusion is also supported by the DSC results shown in Fig. 3a.

2. Morphology of solvent cast 15 wt. % [C_2mpyr][BF_4]/PVDF composites

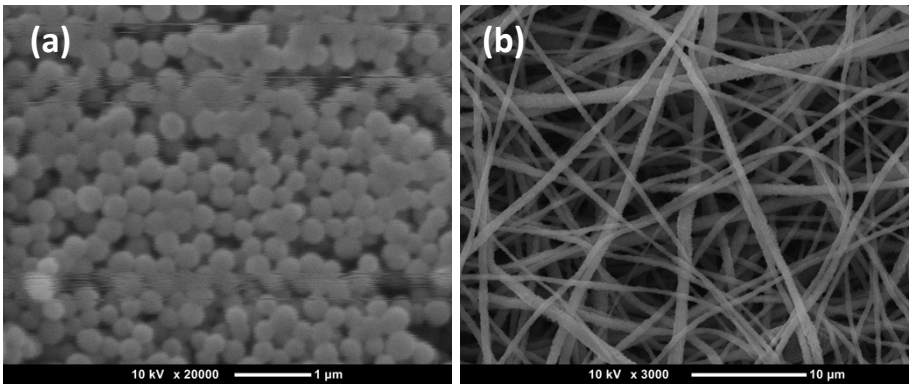

Fig. S2. SEM images of solvent cast 15 wt. % [C_2mpyr][BF_4]/PVDF powder (a) and solvent cast 15 wt. % [C_2mpyr][BF_4]/PVDF fibers

3. Ionic conductivity measurement

a) The bulk resistance (R_b) of the sample was determined from the touchdown point of the Nyquist plot and the ionic conductivity was calculated using the following equation:

$$\sigma = \frac{L_0}{R_b \cdot S}$$

where L_0 is the thickness of the membrane, S is the contact area between sample and electrode (the size of the sample in this paper).

b) Single fiber conductivity

For preparation of the single fibers, the same electrospinning set-up was used but with a different collector. First, the aligned fibers were collected using two grounded parallel stainless steel wires, which is similar to the previous report. [2] The distance between the two wires was kept at 2 cm. Because of the aligned electrical field generated between two wires, the fibers can be easily suspended across the gap between the two wires and can easily be transferred onto the glass slide. The individual fiber can be obtained by removing the other separated fibers under a microscope. For the ionic conductivity measurement of the single fiber, the previously reported method was followed.[3] First, a silica capillary was placed onto the single fiber perpendicularly. Gold sputtering was used to deposit a thin layer of gold onto a glass substrate, to use as the electrode, then the capillary was removed to get two gold electrodes separated with fresh single fiber. Finally, the two electrodes were connected to Solartron Modulab for EIS measurement. As shown in Fig. S3, the distance between the two gold electrodes was 50 μm and the diameter of the single fiber was 1.2 μm.

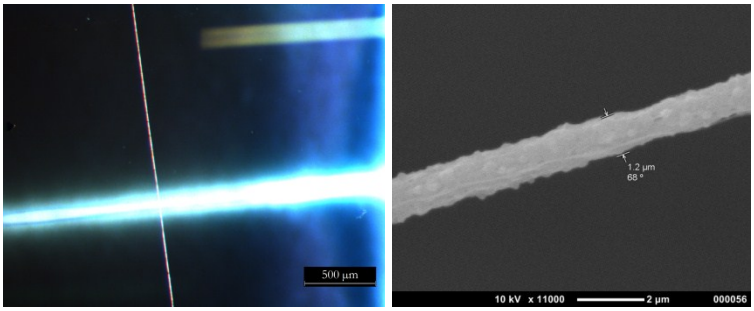

Fig. S3. (a) The microscopy image of the single 10 wt. % [C_2mpyr][BF_4]/PVDF electrospun fiber with two sputtered Au electrodes, (b) SEM image of 10 wt. % [C_2mpyr][BF_4]/PVDF single fiber.

References

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3. B. Dong, L. Gwee, D. Salas-de la Cruz, K. I. Winey and Y. A. Elabd, *Nano Lett.,* 2010, **10**, 3785.